

University of California at Riverside
Math Project:

The Development of Math, Working Memory, and Problem Solving in the Elementary Grades

Funding Source: U. S. Department of Education, Office of Educational Research and Improvement

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Purpose: This three-year project focuses on the development of children's mathematical, working memory, problem solving, reading, and reasoning skills. The project started October 1, 2002. The project studies children at risk or not at risk for math difficulties in grades 1, 2 and 3. The goal of the project is to follow the development of children for three years. The project will identify those cognitive processes that are easily changed by instruction, those that reflect individual differences and those in need of additional instructional attention. Our goal is to provide critical information in developing effective instructional programs in mathematical problem solving and related skills that are research based.

Importance of the knowledge gained: There are at least two arguments that can be articulated related to the national importance of this research. The first is in the early identification of children at risk in mathematical problem solving as well as skills related to problem solving (e.g., reading). The diagnosis of children at risk for learning disabilities has become epidemic in the last few years, and few cognitive studies have been validated on this population in the area of problem solving. Students at risk for mathematical disabilities are a large segment of the public school population, and therefore we need to know the processes that underlie problem-solving difficulty in such a large population. More specifically, approximately 50% of all special education placements include children at risk for learning disabilities (20th Annual U.S. Office of Education Report to Congress, 2000). In addition, approximately 80% of all grade 4 children in the U.S. fall below the standards of the New Standards Mathematics exam, suggesting that cognitive difficulties that emerge in grades 1 to 3 related to problem solving are an important research focus.

Second, relations between understanding and skill in mathematics have renewed importance for reforms in mathematics education. These recommendations call for conceptual understanding and decreasing emphasis on routine computational skills. Although these assumptions are not incompatible with our research, we argue that additional research is needed to provide a conceptual basis for our understanding of the way children develop skills in arithmetic in the elementary grades.

Advantages of the project to participating schools

1. Identification of important cognitive and academic skills that improve performance on standardized group tests
2. Early identification of children at risk for math problems.
3. Identification of skills easily changed by instruction that in turn underlies performance on general achievement tests.
4. Identification of skills in which intervention must be directed.

Method: This study administers a large battery of cognitive and achievement tests each year over a three-year period. The total estimated number of children tested across all schools is 300.